



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
FIVE-YEAR REVIEW TYPE Ia
OUTBOARD MARINE CORPORATION SITE
WAUKEGAN, ILLINOIS**

I. Introduction

The United States Environmental Protection Agency (U.S. EPA) Region 5 has conducted a Type Ia Five-Year Review for the Outboard Marine Company site (OMC) pursuant to CERCLA section 121(c), NCP section 300.400(f)(4)(ii), and OSWER Directive 9355.7-02 (May 23, 1991), OSWER Directive 9355.7-02A (July 26, 1994) and OSWER Directive 9355.7-03A (December 21, 1995). This is a statutory review for the remedy (post-Superfund Amendment and Reauthorization Act of 1986 (SARA) final Record of Decision). The purpose of a Five-Year Review is to ensure that remedial action remains protective of public health and the environment and is functioning as designed. A Type Ia Five-Year Review is applicable to the OMC Site because response actions are ongoing (see below). This document will become a part of the Site File.

Site Characteristics:

The OMC site is located near the intersection of Grand Avenue and Sheridan Road on the west shore of Lake Michigan in Waukegan, Illinois, about 37 miles north of Chicago and 10 miles south of the Wisconsin state border.

Waukegan Harbor is an irregularly shaped harbor about 37 acres in area (see attached figure). The areas of concern within the harbor were Slip No. 3 and the Upper Harbor where large quantities of Poly-chlorinated Biphenyls (PCBs) were deposited after discharge from manufacturing facilities operated by OMC. PCB concentrations in Slip No. 3 were greater than 500 parts per million (ppm). In the Upper Harbor, PCB concentrations were between 50 and 500 ppm. Water depths in the harbor generally vary from 14 to 25 feet with some shallow depths in Slip No.3. The harbor sediments consisted of 1 to 7 feet of very soft organic silt (muck) overlying typically 4 feet of medium dense, fine to coarse sand. The sand is generally uncontaminated. A very stiff silt (glacial till) that typically ranges from 50 to more than 100 feet thick underlies the sand. The entire harbor is bordered by 20 to 25 foot long steel sheet piling, except at the Waukegan Port District boat launching areas and at the retaining wall near the harbor mouth. The sheet piles generally extend into the sand layer above the glacial till. There were also a number of ditches and lagoons on OMC property where PCBs were present and were addressed through this remedy.

A small tributary of Lake Michigan drains surface runoff from about 0.11 squares miles of the OMC and North Shore Sanitary District Property (which is directly north of OMC). The system

also drains surface run off from areas west of OMC property and the railroad tracks. This drainage system consists of the 600 by 20 foot Crescent Ditch, the 240 by 10 by 40 foot Oval Lagoon, and the 2,000 by 10 by 20 foot North Ditch. The U.S. Department of the Interior measured the mean daily discharge of the tributary between March and September 1979 as 1.8 cubic feet per second (cfs), with a maximum discharge of 5.3 cfs. The five-year storm event was calculated to be 23 cfs. PCB contamination in the Crescent Ditch, Oval Lagoon and North Ditch ranged from 50 to over 10,000 ppm. However, the areas of hot-spot contamination (over 10,000 ppm) were confined to the Crescent Ditch and Oval Lagoon.

Another area of concern is the Parking Lot area, located north of OMC's Plant No. 2 and is about 9 acres in area. PCB concentrations in this area were between 50 and 5,000 ppm. There are three entrances to the Parking Lot area: two fenced entrances in the northwest corner of OMC's property and one fenced entrance southeast of OMC's new die-cast complex at the intersection of OMC's private road, Seahorse Drive.

The generalized subsurface conditions on the OMC property typically consist of 30 feet of compact, very fine to fine sand overlying a stiff to very stiff silt (glacial till). The thickness of the glacial till typically ranges from 50 to more than 100 feet.

From approximately 1961 to 1972, OMC purchased a hydraulic fluid that contained PCBs for use in its die-casting works. Some of these fluids escaped through the floor drains. The floor drains discharged to an oil interceptor system which discharged to the North Ditch. Some of the PCBs escaped from a portion of the oil interceptor, diversion and pump system and were released directly to Waukegan Harbor. The harbor area discharge was located in the western end of Slip No. 3, and the north property discharge was to the Crescent Ditch. As a result of these discharges, large quantities of PCBs were released in Slip No. 3 of Waukegan Harbor and on OMC property in the North Ditch, Oval Lagoon, Crescent Ditch and in the Parking Lot. It is estimated that there were over 700,000 pounds of PCBs on OMC property and 300,000 pounds of PCBs in Waukegan Harbor. In 1976, these high levels of PCBs were discovered in the soils and harbor sediments on-site. The discharge pipe to the harbor was sealed in 1976.

In 1984, after several studies of PCB contamination at the site and the completion of a Feasibility Study (FS) which analyzed various alternative remedies to clean up the contamination, U.S. EPA, pursuant to CERCLA, selected a recommended remedial alternative to be implemented, using monies from the Hazardous Substance Trust Fund. This remedial selection is set forth in the 1984 Record of Decision (ROD) authorizing expenditures of \$21 million to clean up the site. That same year, the engineering design work for the selected remedial action was initiated. However, in late 1985, design work on the project was suspended due to litigation between OMC and EPA regarding EPA access to OMC's property (access was essential to continue the design process).

While this litigation was pending before the courts, SARA was enacted. The SARA amendments call for the preference for "permanent remedies which reduce the mobility, toxicity,

or volume of hazardous substances.” Although RODs signed prior to October 1986 were not required to meet these new requirements, U.S. EPA reevaluated the 1984 ROD to develop a remedy consistent with SARA.

Around the time EPA began its review of the remedy, U.S. EPA and OMC agreed to end the ongoing access litigation. Shortly thereafter, OMC submitted a proposal to clean up the site and OMC, U.S. EPA and the Illinois EPA (IEPA) entered into a Consent Decree in 1988. Under this decree, OMC established a Trust to finance the clean up.

II. Discussion of Remedial Objectives

In 1989, EPA completed its review of the 1984 ROD and modified the remedy to include the following:

- A new slip would be constructed on the east side of the Upper Harbor to replace Slip No. 3 and Larsen Marine would be moved to the new slip.
- Slip No. 3 would be permanently isolated from the Upper Harbor by construction of a double-walled, braced, and soil backfilled sheet pile cutoff wall. After the slip was isolated, an impermeable clay slurry wall with a minimum thickness of three feet would be constructed around the slip and keyed into the underlying clay till, and a permanent containment cell would be built in the slip.
- The most highly contaminated sediments from Slip No. 3 (PCB concentrations in excess of 500 ppm) would be removed from the slip and treated on-site. The Upper Harbor would be dredged and contaminated sediments removed. These dredged materials would be placed in the newly constructed Slip No. 3 containment cell.
- Two additional containment cells (East and West) would be constructed using the same design used for the construction of the Slip No. 3 Containment Cell. The East Containment Cell would encompass part of the Parking Lot area and land to the east of the lot. The West Containment Cell would encompass the Crescent Ditch and Oval Lagoon area. Before constructing the West Containment Cell, soils contaminated in excess of 10,000 ppm will be excavated and removed for treatment. The East Containment Cell would contain soils from the parking lot. These soils would not receive on-site treatment because they are generally below the 500 ppm criteria.
- Soils and sediments excavated from Slip No. 3, and the North Ditch, Crescent Ditch and Oval Lagoon area designated for treatment would be subjected to an on-site thermal technology. After startup, the treatment technology was required to meet a 97% PCB mass removal. The treated material would then be placed in the West Containment Cell. Extracted PCBs would be disposed of off-site in accordance with all applicable Federal and State Laws. The average PCB concentration in the West Containment Cell would be

90 ppm.

- A short-term water treatment facility would be constructed for treating water generated during the remedial construction activities. Dredge water would be treated by sand filtration. Other water generated during the course of the remedial activity would be treated utilizing the sand filtration step to remove sediments from the water, followed by carbon adsorption.
- A smaller permanent water treatment facility would be constructed to treat water extracted from the containment cells. Treated water would be discharged to the North Shore Sanitary District or on-site.
- Once all of the materials have been deposited in the containment cells, the cells would be closed and capped with a high density polyethylene (HDPE) liner and soil cover. The cells would include the installation of an extraction well system designed to prevent the migration of PCBs from the cells by maintaining an inward hydraulic gradient at all times.

In April of 1989, the Harbor Trust (enabled as a result of the Consent Decree) contracted with a remedial contractor to design and perform the remediation of the site. The major remedial activities at the site included:

- The remedial design for the containment of PCB-impacted soil and sediments at Waukegan Harbor and the surrounding land.
- Construction of a new boating slip for the relocation of Larsen Marine Services.
- Isolation of Slip No. 3 for the containment of Upper Harbor sediments by installing vertical sheet piling and slurry walls and capping with a synthetic liner and soil cover.
- Hydraulic dredging of designated sediments in Slip No. 3 for thermal treatment and hydraulic dredging of designated Upper Harbor sediment for placement in Slip No. 3 for containment.
- Excavation and thermal treatment of 12,750 tons of impacted soil and sediment.
- Construction of two containment cells (the East and West Containment Cells) on the northern area of the site by installing slurry walls and capping with synthetic liners and soil covers.
- Restoration of the North Ditch by excavation of designated sediments, placement in the West Cell, and backfilling the North Ditch with clean sand.

- Construction and operation of water treatment plants to treat the following 7 different categories of waters generated during construction and operation of the remedial action:

Category 1 - water produced during dredging of the Upper Harbor

Category 2 - water produced during the dewatering of Slip No. 3.

Category 3 - water produced during the dewatering of the West Containment Cell

Category 4 - water produced from the thermal treatment of soils.

Category 5 - a mobile system for water removed from the cells to control gradient.

Category 6 - water from the retention pond dewatering (high pressure gas main re-route).

Category 7 - water produced from the initial draw-down of the East Containment Cell.

- Installation and operation of an extraction well system at each containment cell to maintain an inward hydraulic gradient.

A number of modifications were made to the system design. The more significant modifications include:

- Additional treatment equipment was added to the Category 2, 3 and 4 treatment plants to remove more oil from the influent stream.
- The slurry walls were, on average, keyed 3.5 rather than 3.0 feet into the underlying till.
- Additional excavation in the East Containment Cell of contaminated soil found during the gas main reroute.
- The Category 1 treatment system was changed from gravity to pressure sand filters.
- Obstructions at the clay till surface at all three containment cells were discovered while attempting to set the slurry wall. Two of the three cells required modification to the slurry wall alignment.
- Soils contaminated with Polynuclear Aromatic Hydrocarbons (PNAs) were discovered in the area proposed for the New Slip. For this reason, the slip and slurry wall location and alignment were changed.
- A temporary storage area was constructed to manage the PNA contaminated soils removed from the slip.
- A storm water retention basin was constructed to capture run off from Plant 2 during construction activities.
- During the startup operations, the thermal desorption unit was modified to meet the required destruction removal efficiency air emission standards.

The New Slip was opened in the Upper Harbor in July of 1991. Shortly thereafter, Larsen Marine Service moved from Slip No. 3 to the New Slip. The conversion of Slip No. 3 to a containment cell included the construction of a sheet pile cut-off wall at the entrance to the slip (construction began in July of 1991). Backfilling of the cut-off wall was completed with approximately 8,800 cubic yards of soil-bentonite material. This activity was complete in November of 1991. Soils with PCBs concentrations of 500 parts per million (ppm) were removed from Slip No 3 and thermally treated on-site and dredged sediment from the area adjacent to Slip No. 3 was backfilled in Slip No. 3. This dredging and backfilling began in August of 1991 and was completed by December 1991. Slip No. 3 was dewatered, approximately 572,000 gallons of water was removed during this dewatering and passed through the Category 5 treatment plant. After a sufficient degree of settling of the materials, construction activities for placement of the final cap for the Slip No. 3 Containment Cell began in August of 1994 and completed in December 1994.

Two areas required dredging in the Waukegan Harbor: Slip No. 3 and the northern 980 feet of the harbor (Upper Harbor). Dredging was completed to a designated elevation or soils type (i.e., clay or sand). Confirmation sampling was taken at the base of dredge to verify that contaminants levels required for this cleanup were met. Dredging was completed for Slip No. 3 in December 1991. Silt curtains were installed and the Upper Harbor was raked to collect to gather oversized debris prior to dredging. Dredging began in January of 1992 and was completed by the end February 1992.

The highly contaminated soils that were placed into Slip No. 3 were treated using the ATP process. The ATP process resembles a rotating kiln and contains 4 separate internal sections: preheat, retort, combustion, and cooling. Approximately 12,700 tons of PCB contaminated material was treated. This treatment anaerobically desorbed approximate 30,000 gallons of PCB oils from the contaminated soils. These oils were then disposed of off-site and the residual soils were placed in the containment cells.

The West Containment Cell was designed and built to contain PCB contaminated soils with concentrations greater than 50 parts per million excavated from select areas on site and residual treated soils. Work began on the West Containment Cell in May of 1992. Soils not requiring thermal treatment from the Oval Lagoon and Crescent Ditch were placed in the West Containment Cell. The excavation of the Crescent Ditch was completed in October of 1991 and the Oval Lagoon was completed in January of 1992. The final cover was placed on the West Containment Cell in November of 1992. Once the cell was capped, dewatering was conducted. Approximately 210,000 gallons of water were treated from the West Containment Cell through the Category 5 water treatment plant between December 1992 through February 1993. From September of 1993 through July of 1994, an additional 1,900,000 gallons of water was removed and treated to develop and maintain an inward gradient of groundwater into the cell.

The East Containment Cell was also designed and built to contain PCB contaminated soils with

concentrations greater than 50 ppm. The cell was constructed over 2 construction seasons due to delays is the re-routing of a high pressure main. The slurry wall construction for the East Containment Cell began in July of 1992 and was completed in May 1993. The final pavement was placed on the cap in August 1993. A total of 1,332,000 gallons of water was removed in the initial cell dewatering from July to November, 1993.

During the construction of the New Slip for Larsen Marine Services (to replace Slip No. 3), soil contaminated with polynuclear aromatic hydrocarbons (PNAs) was discovered. The slip was constructed within a portion of the OMC property which is now referred to as the Waukegan Manufactured Gas and Coke Plant site, or Operable Unit 2 of the OMC site. These PNA contaminated soils were place in a temporary stockpile lined and covered with high density polyethylene. It is anticipated that the final disposition of this material will be addressed during the RI/FS and ROD for the Waukegan Manufactured Gas and Coke Plant site.

All of the remedial construction activities for the site were completed between November 1990 and December 1994. In total, over 30,000 cubic yards of sediment were removed from the Upper Harbor. Over 12,000 tons of the most heavily impacted soil and sediment were thermally treated and the lesser impacted sediments were isolated in three on-site cells totaling approximately 12 acres in size. The performance standards for the remedial activities were met during remedy construction and the site has transitioned into the long-term operation and maintenance program in accordance with the approved Operation and Maintenance (O&M) Plan.

The only significant change between the end of cell construction and the date of this report is the use of dedicated pump-and-treat systems on the cells. Initially, an inward gradient was maintained by pumping each cell and treating with a mobile carbon filtration system. This approach required a significant draw down in each cell. This large draw-down of water within the cell may have resulted in increased inflow into the cell and, subsequently, a larger volume of water requiring treatment. In an attempt to minimize the volume of water needing treatment and for ease of long term management, permanent dual series carbon treatment systems were added to each of the cells during 1996. This allows for a more routine extraction (less severe gradient) within the cell. The fixed systems are designed to allow extraction from an individual recovery well (each containment cell has two recovery wells) or multiple wells concurrently. The systems have automatic shut-offs for excess pressure and built-in flow restrictors to limit the maximum pumping rate. The treatment systems for the cells are equivalent except for the carbon vessel size and the maximum inflow rate. The Slip No. 3 Containment Cell system has two-200 pound carbon tanks (400 pounds total) with a maximum pumping rate of 15 gallons per minute (g.p.m), while the East and West Containment Cell systems each have two-300 pound carbon tanks (600 pounds total) with a maximum pumping rate of 20 g.p.m. All three systems are up and running and, with the exception of minor maintenance and condensation problems, appear to be functioning properly.

1. Monitoring Program

There are a series of long-term monitoring requirements for this site, including both physical and chemical parameters which are outlined below.

A. Physical Requirements

Maintenance of a inward hydraulic gradient is continually required across the length and width of each containment cell. This is achieved by removal of water from within the cell by pumping the two recovery wells. To illustrate this gradient, periodic comparisons are made of the water levels inside versus outside of each cell. There was one significant event in which an inward gradient was not maintained on a cell for almost a month. Since this event, hydraulic gradients have been achieved and maintained in each of the cells. Long-term monitoring of these physical characteristics are ongoing, pursuant to the 1988 Consent Decree.

For each of the three containment cells, the top surface of the final cover consists of either bituminous concrete or top soil overlying a drainage layer and a high density polyethylene synthetic liner. The surface of the cover is routinely inspected and repairs will be completed as soon as practicable after the discovery of the need for repair. Areas where bituminous concrete cover is installed are inspected each spring during the post-closure care period. Cracks will be sealed with asphalt sealer, potholes or other deterioration of the asphalt surface will be repaired using procedures recommended by the Asphalt Institute. The vegetative cover is also inspected each spring. Any gullies or washouts in the top soil will be backfilled, compacted, reseeded and mulched with an appropriate material. Stressed or dead areas of vegetation will be similarly treated. The vegetative areas will also be mowed at least twice per year and fertilized occasionally. The O&M Plan also contains detailed procedures if cap repair is required.

As stated previously, during the construction of the New Slip to replace Slip No. 3 for Larsen Marine Services, soil contaminated with polynuclear aromatic hydrocarbons (PNAs) was discovered. These PNA contaminated soils were placed in a lined temporary stockpile and covered with high density polyethylene. A sump is routinely measured for liquid accumulation within this stockpile and pumped out as needed. The condition of the cover is inspected monthly.

B. Chemical Requirements

There were 5 discharge categories during the remedy construction. These discharges were monitored for the following:

Table 1

Type of Water	PCB Effluent Limit	Monitoring Frequency	Flow
Dredge Water	15 ppb	Daily	1,000 g.p.m.
Slip 3 Water	5 ppb	Daily	100 g.p.m.
Construction Water	5 ppb	Daily	100 g.p.m.
Soil Process Water	5 ppb max (1 ppb 30 day average)	Soil Processor-Daily Carbon -Weekly	5-10 g.p.m.
Containment Cell	1 ppb (30 day average)	Weekly for 6 Months, Decreasing	10 g.p.m.

ppb - parts per billion

g.p.m. - gallons per minute

The Category 5 (containment cells) discharges continue, while the other categories are largely complete. All remaining discharges are conducted under permit and either directly discharge to the North Ditch or the City sewer. Although PCBs are detected in the influent removed from the cells, the systems effluent samples (post-treatment) document that discharges are meeting the permit requirements (including required PCBs, pH, temperature, oil and grease and suspended solids measurements).

The site also has an ongoing ground water monitoring program. This program consists of detection monitoring, compliance monitoring and corrective action programs. The detection monitoring addresses the routine, ongoing monitoring of the containment cell function. Compliance monitoring is implemented if detection monitoring identifies a change that may suggest a deterioration in the function of any containment cell. If compliance monitoring determines that contaminants from a containment cell are migrating beyond the slurry walls, then corrective action will be taken. A total of 12 ground water wells were installed after completion of the slurry walls. These wells are analyzed for PCBs quarterly for the first two years and semi-annually for the remainder of the post-closure period.

Semi-annual sampling has commenced for the site and sampling indicates that the cells appear to be functioning properly. However, it should be noted that during the period between the completion of the containment cells and the construction of the permanent treatment plants at each cell, U.S. EPA identified several significant issues regarding sampling and analytical methods and results for the inward gradient ground water monitoring. These problems resulted in the need for compliance monitoring, but the gradient and sampling issues were subsequently resolved through improved sampling and analytical methods and dedicated extraction systems. As a result, the O&M Plan was modified to reflect improved methods and subsequent monitoring results illustrate that the cells appear to be functioning properly.

III. Recommendation

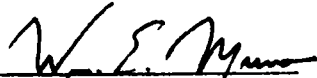
The slip has been constructed, the temporary PNA stockpile is complete, the construction of the three containment cells and placement of the contaminated soils and sediments within those cell has been completed and construction of the requisite fixed treatment plants have been completed. Sampling indicates that there continues to be an inward gradient into the cells, the treatment system is meeting the discharge requirements and ground water sampling does not indicate the presence of PCBs outside the cells. Therefore, U.S. EPA recommends continued operation of these remedy components, as designed, until the appropriate ROD and Consent Decree requirements are met.

IV. Statement on Protectiveness

With the continued containment cell inward gradient, the ongoing treatment of water removed from the cells, ongoing maintenance of the cells and all other aspects of the O&M plan, this remedy remains protective of human health and the environment. This is demonstrated by the results of performance sampling which indicate that the systems are operating according to design and meeting the requirements of the ROD and Consent Decree.

V. Next Review

The next review for the OMC site is scheduled to be completed by June 24, 2001.


William E. Munro, Director
Superfund Division

9/20/98
Date

ATTACHMENT 1
FIGURE 1.
OMC SITE MAP

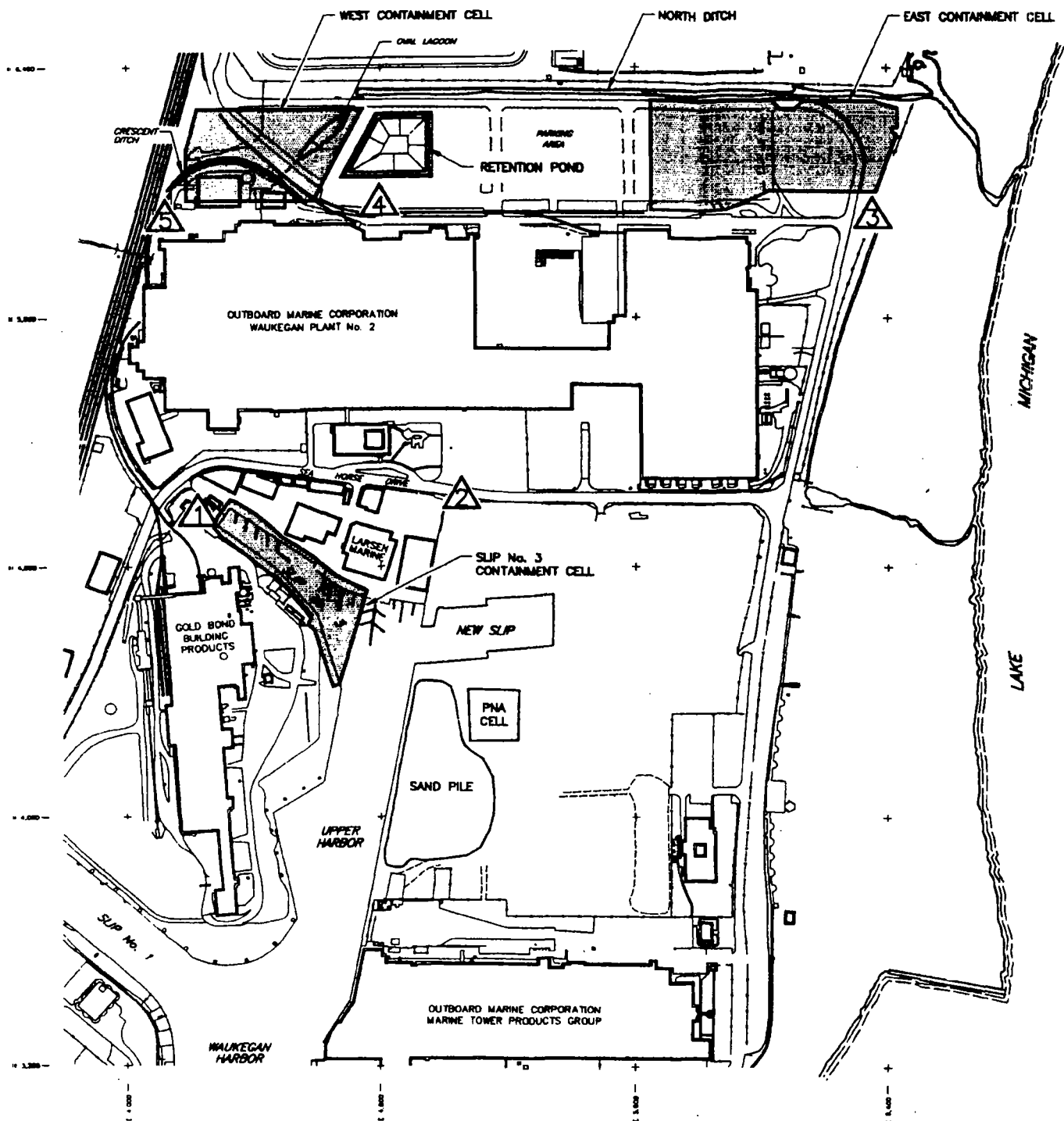


Figure 1.
OMC Site Map